Fisheries and Oceans Science / Pêches et Océans Sciences

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Research Document 2001/060 / Document de recherche 2001/060

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A Brief Review of Biological Characteristics and Assessment of the Commercial Gaspereau Fishery on the Lower Saint John River, N. B.

Aperçu des caractéristiques biologiques du gaspareau de la rivière Saint-Jean inférieure (N.-B.) et évaluation de sa pêche commerciale

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ISSN 1480-4883
Ottawa, 2001

Canada

Abstract

The trap-net fishery of the lower Saint John River typically harvests 70-90% of the gaspereau caught downstream of the Mactaquac Dam. The gaspereau catch of the lower river has been below its long-term mean for over 20 years. Biological data collected periodically since 1973 indicates that high fishing pressure has reduced the proportion of fish older than age-8 and the proportion of previous (repeat) spawners in the various fishing areas (geographic substocks). Exploitation rates must be reduced if any substantive increase in future catch is to occur.

Résumé

La pêche fixe dans la basse rivière Saint-Jean capture habituellement de 70 à 90 % des gaspareaux pêchés en aval du barrage Mactaquac. Depuis plus de 20 ans, les captures de gaspareaux dans la basse Saint-Jean sont inférieures à la moyenne à long terme. Les données biologiques recueillies périodiquement depuis 1973 indiquent que, dans les divers secteurs de pêche (sous-stocks géographiques), la forte pression de pêche a réduit la proportion des poissons âgés de plus de huit ans ainsi que la proportion de géniteurs ayant déjà frayé. Il faut réduire les taux d'exploitation pour obtenir des hausses significatives des prises futures.

Introduction

Anadromous alewives *Alosa pseudoharengus* and blueback herring *A. aestivalis*, jointly and commonly called gaspereau, river herring, or simply alewives, support an important commercial fishery (1950-2000 mean catch of 2,284 t) on the Saint John River, New Brunswick (Figures 1, 2). Over the past 50 years, this fishery has ranked as either the largest or second largest gaspereau fishery in New Brunswick and the Maritime Provinces, depending upon its catch relative to that of the Miramichi River. Jessop (1999) analyzed the Saint John River gaspereau fishery in terms of catch and effort statistics. This report will examine the available biological data.

Stock and Fishery Characteristics

Maturing gaspereau may move into the lower Saint John River, e.g., Kennebecasis Bay, as early as January but the major upstream spawning migration begins, depending upon annual weather conditions, about late April, peaks in late May or early June, and is typically completed by early July (Jessop 1977a; Messieh 1977). The run peaks progressively later with distance travelled upstream. Alewives enter the river first, followed by blueback herring 2-3 weeks later. Biological and tagging evidence for the existence of geographic subpopulations of alewives and blueback herring within each major tributary lake, including Mactaquac Lake, is presented by Messieh (1977), Jessop et al. (1983) and Jessop (1990; 1994). Both species recruit to the spawning stock by platoon (i.e., only part of a year-class is recruited in a given year; Ricker 1975) over 3 or 4 years between ages 3 and 6, mostly at age 4 or 5. Annual returns are composed of varying numbers of both virgin recruits and previous spawners. Variable, usually small, numbers of immature two and occasionally three-year-old alewives and blueback herring enter Washademoak and Grand lakes during June, at the end of the spawning run, while small quantities of yearling alewives and blueback herring enter during July and August (Jessop 1994).

A fixed and drift gill-net fishery for gaspereau occurs in the Saint John harbour downstream of the Reversing Falls (Fishery Statistical Districts (FSD) 48-49). The annual catch of this fishery has averaged (1950-2000) 17.2% of the total catch from the river but has been highly variable (range 0-66%) and cyclical. Since 1995, the harbour catch has declined to an average of 8% (range 3-17%) of the total river catch, as compared with an average of 17.3% (range 3-48%) during the period 1990-2000.

The primary gaspereau fishery is by trap-net in the tributary rivers and lakes downstream of the Mactaquac Dam (FSDs 55-57) although a minor set gill-net fishery (< 1% of total catch in FSDs 55-57) also occurs (Figure 1). The trap-net fishery typically harvests 70-90% of the commercial gaspereau catch taken downstream of the Mactaquac Dam, with most of the remainder taken in the harbour fishery (Table 1). No trap-net fishing has been permitted in the main stem of the river, with minor, periodic exception. Three experimental trap-nets have been permitted in the Long Reach area since 1995 although often only one or two are fished. Since 1950, the total catch of gaspereau from the Saint John River fishery (FSDs 48-49, 55-57, and Mactaquac Dam) has varied markedly, with major peaks in 1954 and 1971, followed by a decline with a minor peak in 1989 to recent low values (Table 1; Figure 2). The peaks are 17-18 years apart and may indicate underlying cycles of an unknown nature. The catch by the downstream fishery has been below (presently 30% below) its 1950-2000 mean of 2,087 t for 23 years.

No specific management action has been taken to regulate this fishery other than to freeze (in 1982) the number of trap and gill-nets licensed (a single trap-net license may permit use of a variable number of trap-nets) and to close the fishery earlier (mid- to late June rather than June 30) by Variation Order, moving the closure progressively upriver as Atlantic salmon enter the lower river. One consequence of earlier closure of the fishery is greater pressure on alewives and less pressure on blueback herring. In response to the generally progressive decline in catches since the peak in 1971 (Figure 2), trap-net fishermen in the lower Saint John River have slightly reduced the number of nets licensed (125) in the early 1980s (Jessop 1986) to 103 trap-nets licensed to 12 fishermen during the late 1990s (Jessop 1999). In the late 1970s and early 1980s, the number of nets set often exceeded 100 (Jessop 1986). In 1994, 57 trap-nets were reported set (J. Kierstead, Fishery Officer Saint John, N.B.) while log-book data indicated that 44 nets were set in 1998 and 66 nets in 1999. The seasonal operating period may vary among traps. The gaspereau fishery

log-book data available since 1988 indicate that trap-net fishing effort and catch-per-unit-effort (CPUE) have varied widely but with trends towards increased fishing effort and decreased CPUE, if the less representative data of 1988 and 1989 are fully weighted (Jessop 1999). Otherwise, no trend in fishing effort and CPUE is evident over this period. The harvest capacity presently employed, and potentially available for use should stocks recover, is believed excessive (Jessop 1986), particularly given that present catch levels in FSDs 55-57 are well (about 22%) below the long-term mean catch (Figure 2).

Methods

Fork length (to 1 mm), weight (to 0.1 g), sex, maturity and age (scales) data were taken for samples of alewives and blueback herring collected during the spring commercial fishery from several sites on major tributary rivers and lakes in the lower Saint John River (Figure 1) on an irregular basis of 3-4 years per decade since 1973 (Jessop 1977a,b,c; Jessop et al. 1983; and unpublished data). Sample sizes were typically 50 fish during the 1970s and 100 fish in later years, although target sample sizes were sometimes not achieved. All fish were aged during the 1970s and 1980s but only 50% of fish were aged during the 1990s, with a consequent decrease in summary statistic precision. An electronic measuring board was used during 1997 and 1999-2000 and on some dates during 1998 for the Oromocto River samples. The bias-adjusted measurements of the electronic measuring board are assumed to be comparable to those made with traditional measuring boards (Chaput et al. 1992) although measurement variability is increased by the conversion from one measurement form to another. Samples were typically measured fresh although in 1998 the samples were frozen prior to processing. No adjustment has been made for shrinkage in length or weight due to freezing. Shrinkage in length is typically about 3-3.5%, with the greater shrinkage occurring at smaller lengths (Chaput 1993). During the 1970s and 1980s, scales were aged twice with a third reading to resolve disagreements but during the 1990s, scales were aged only once and by a less experienced reader, with consequent likelihood of increased ageing error.

The sites most frequently sampled were Washademoak Lake, Grand Lake, French and Indian Lakes (hereafter French-Indian Lake), and the Oromocto River, with Belleisle Bay, Kennebecasis Bay, and sites on Long Reach less frequently sampled (Figure 1). During 1973 and 1974, multiple sites were sampled in Washademoak Lake (lower, middle) and the data from these sites has been pooled. Grand Lake was not sampled during 1975 or the 1990s, Kennebecasis Bay was sampled only in 1974, 1975 and 1981, and Belleisle Bay was sampled only in 1974. Consequently, these sites are not further examined here. The sampling sites at French-Indian Lake, Oromocto River and Washademoak Lake have remained essentially constant over the years. Each major site was typically sampled weekly throughout the fishing season (late April-early May to mid-late June) during the 1970s and 1980s. During the 1990s, sampling in most years occurred between late April and late May. The blueback herring run was incompletely sampled, particularly during the 1990s, because fishing activity declines and the fishery closes during the blueback herring run due to market conditions. Also, since the mid-1980s, the fishery has been closed on or before June 15 by Variation Order to prevent the bycatch of migrating Atlantic salmon. Incomplete sampling of the blueback herring run would tend to overestimate the annual mean size and age because the size and age composition of the fish declines over the run. Weekly sample sizes of the age composition of male and female blueback herring from the Oromocto River and French and Indian Lakes were often less than 5 fish and consequently were not further examined.

Results

Annual mean sample fork lengths and weights of alewives and blueback herring, by age group, from downstream commercial fishing areas increased with age and varied significantly among years, as can be seen in the degree of non-overlap of many 95% confidence intervals (Figures 3-6; Appendices 1-2). Alewife and blueback herring data from sites or ages other than those selected were not plotted due to the high proportion of small (less than 5 fish) samples at a given age or less complete annual coverage. The variability over time in annual mean size is little influenced by the proportion of previous spawners (which declined from the 1970s and 1980s to the 1990s) because the annual mean size at age changes little with an increasing number of spawns. The pattern of annual change in mean size varies because of the changing mix of year-classes. Thus, the mean length or weight of a five year old fish with one or two

previous spawns may be smaller or larger than for virgin five year olds but the difference is usually not statistically significant (Jessop 1977a-c; Jessop et al. 1983). Different year-classes may vary in fish size and age at partial recruitment due to the effects on growth of varying marine environmental conditions.

Age-4 alewives from the Washademoak and French-Indian lakes were particularly small during 1999. Examination of the data indicates that this decline is not a sampling artifact due to ageing only half of the annual sample or use of the electronic measuring board. An ageing bias may have occurred, with some age-3 fish being called age-4, but age-3 fish are typically present in small numbers (less than 10 fish per annual sample), and any bias to the much larger sample of age-4 fish should be minimal. Occasional year-classes of unusually small age-3 and -4 alewives and blueback herring occur for unknown reasons (presumably poor marine feeding conditions) and it is possible that such an influx occurred in 1999.

Annual mean lengths and weights (all ages combined) of male and female alewives and blueback herring varied significantly ($P < 0.05$) among years, with males typically smaller than females for both species (Figures 7, 8). Annual mean lengths and weights of the combined sexes of both species tended to cluster within the decadal periods sampled (annual mean sex ratios averaged approximately 1:1 male:female for both species), and thus annual means were pooled within the decadal periods. Alewife and blueback herring mean lengths and weights varied significantly ($P < 0.001$) for each sex among decadal periods, with lengths and weights being higher during the 1980s than in the 1970s and much lower during the 1990s than during the 1970s or 1980s (Table 2).

Most alewives (about 70-80%) were ages 4 and 5 but the annual percentages at each age may vary widely, depending upon the pattern of partial recruitment (Figure 9). Most blueback herring (65-75%) were also ages 4 and 5 (Figure 10). The median percentage of alewives age-8 and older among sites has varied over time, from 1.1% (range 0-1.9%) during the 1970s, to 2.0% (range 0-8.5%) during the 1980s, and declining to 0% (range 0-0.9%) during the 1990s. Similarly, the median percentage of blueback herring age-8 and older (from annual sample sizes greater than 30 fish) has varied among sites from 0% (range 0-5.4%) during the 1970s, to 2.8% (range 0-10.2%) during the 1980s, and decreasing to 0% (range 0-4.7%) during the 1990s. The proportion of previously-spawned alewives has declined to 0.1-0.4 during the 1990s from 0.4-0.7 in earlier years (Figure 11).

Discussion

The annual spawning stock sizes are unknown for each of the tributary lakes and rivers of the lower Saint John River. However, the persistence of commercial catches well below the long-term mean and declines during the 1990s in mean fish size, abundance of older age-groups and in the proportion of previous spawners to levels below 0.4 is indicative of heavily fished stocks and low spawning stock sizes (Trippel 1995; Jessop 2001). A proportion of previous spawners below 0.2 for two years in the French-Indian Lakes area suggests excessive fishing pressure (Jessop 2001). Although the size at maturity of heavily exploited populations may decline over time (Hutchings 2000; Stokes and Law 2000), it is difficult to separate such effects, in the short term, on the gaspereau stocks of the Saint John River from those due to environmental conditions. Unless fishing pressure is reduced, the prognosis is for catches to fluctuate well below the long-term mean.

Acknowledgements

I thank all those who have participated with me in the sample collection and processing and scale ageing since this project began, particularly W. E. Anderson, H. A. Parker, H. H. Stone, D. Ingraham, L. Anderson, and R. Jones.

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Table 1. Annual gaspereau landings (t) by Fishery Statistical District (FSD) and the Mactaquac Dam, from the Saint John River, N.B., 1950-2000. During the 1980s, data from the Statistics Division often differed from data derived from log-books (in brackets); the larger figure is preferred. More recently, log-book and Statistics Division data are reconciled before being finalized.

Year	FSD 48-49	FSD 55	FSD 56	FSD 57	FSD Total	Mactaquac	Total
1950	790.0	54.0	193.7	158.7	1196.4	0	1196.4
1951	1090.7	98.0	464.4	44.9	1698.0	0	1698.0
1952	1743.3	242.2	537.0	523.8	3046.3	0	3046.3
1953	927.9	148.3	2795.5	771.0	4642.6	0	4642.6
1954	931.1	56.7	3659.4	1237.2	5884.4	0	5884.4
1955	418.6	36.3	3110.2	820.9	4385.9	0	4385.9
1956	248.1	4.5	1675.3	948.8	2876.6	0	2876.6
1957	410.0	12.2	2175.1	568.7	3166.0	0	3166.0
1958	661.2	131.1	650.3	620.9	2063.5	0	2063.5
1959	345.6	43.5	492.1	1005.4	1886.6	0	1886.6
1960	340.1	44.4	1540.6	389.1	2314.3	0	2314.3
1961	1266.2	100.2	959.2	453.5	2778.1	0	2778.1
1962	1078.9	140.6	938.8	707.5	2865.8	0	2865.8
1963	707.0	66.2	662.6	127.4	1563.3	0	1563.3
1964	367.4	261.2	589.6	195.5	1413.6	0	1413.6
1965	728.3	120.2	1528.3	916.1	3293.0	0	3293.0
1966	85.7	260.8	1104.8	321.1	1772.3	0	1772.3
1967	98.4	184.1	414.1	972.8	1669.4	0	1669.4
1968	32.2	193.7	975.1	927.0	2127.9	0	2127.9
1969	13.6	129.7	1669.8	711.1	2524.3	0	2524.3
1970	82.1	161.5	1035.8	1453.1	2732.4	0	2732.4
1971	149.2	114.3	4768.7	1385.9	6418.2	0	6418.2
1972	16.3	249.9	2568.7	1195.5	4030.4	0	4030.4
1973	52.2	230.4	1287.1	975.5	2545.1	0	2545.1
1974	12.3	263.5	1516.1	1337.4	3129.2	156.7	3285.9
1975	30.8	152.8	953.7	763.7	1901.1	322.2	2223.3
1976	33.1	150.1	949.7	971.9	2104.8	571.7	2676.5
1977	30.8	155.1	1653.5	649.9	2489.4	876.7	3366.1
1978	57.1	177.8	1322.0	719.7	2276.6	990.5	3267.1
1979	0	142.0	884.8	644.0	1864.9	610.2	2280.9
			(1079.0)				(2475.1)
1980	96.6	88.0	789.1	146.0	1379.7	846.0	1965.8
	(53.5)	(910.4)	(319.2)				(2225.7)
1981	104.0	22.0	759.6	88.0	1082.7	465.8	1439.4
	(16.4)	(874.3)					(1548.5)
1982	58.0	13.0	566.0	277.0	1153.5	258.4	1172.4
	(8.5)	(964.4)	(118.1)				(1411.9)
1983	79.0	30.0	508.0	349.0	1064.3	172.0	1138.0
	(17.9)	(904.2)	(66.0)*				(1236.3)
1984	111.0	17.0	538.0	105.0	799.8	280.7	1096.7
	(0)	(621.8)	(64.2)				(1080.5)
1985	46.0	22.0	636.0	61.0	765.0	397.6	1162.6
1986	122.0	7.0	519.3	149.6	798.0	0	798.0
1987	289.0	116.0	590.0	319.0	1314.0	611.3	1925.3
1988	311.0	159.0	709.0	321.0	1500.0	615.3	2115.3
1989	375.0	560.0	438.0	0.0*	1372.0	968.9	2341.9
1990	544.4	232.2	280.2	364.8	1636.0	122.7	1758.7
1991	293.3	198.0	496.8	442.7	1430.8	217.4	1648.1
1992	351.6	54.1	332.7	405.4	1143.8	277.0	1420.8
1993	242.1	82.3	254.6	239.0	818.0	144.9	962.9
1994	160.6	85.0	145.6	138.1	529.3	78.9	608.2
1995	162.4	40.8	326.8	387.8	917.8	55.2	973.0
1996	89.3	13.1	662.2	251.9	1060.4	63.0	1081.1
1997	173.3	100.7	518.7	369.7	1181.0	338.0	1519.0
1998	82.7	75.6	484.3	651.9	1294.5	329.0	1623.5
1999	39.3	51.6	696.2	536.6	1323.8	166.9	1490.7
2000	50.7	47.1	521.6	618.3	1237.6	140.1	1377.7

*Data incomplete or incorrect.

Table 2. Decadal mean lengths and weights, by sex, of alewives and blueback herring from the commercial fisheries in tributaries of the lower Saint John River, NB, 1973-2000. All row means are significantly different ($P<0.001$).

Site	Species	Sex	Decade 1970s	1980s	1990s
			Length (mm)		
Washademoak L.	Alewife	M	249.1	258.7	241.6
		F	262.4	270.8	250.5
	Blueback	M	212.8	217.6	200.0
		F	226.1	232.8	213.5
French-Indian L.	Alewife	M	253.0	262.8	239.7
		F	262.0	272.4	248.6
Oromocto R.	Alewife	M	257.9	262.6	241.1
		F	268.9	274.3	249.3
			Weight (g)		
Washademoak L.	Alewife	M	208.5	238.8	185.3
		F	248.5	274.1	211.0
	Blueback	M	123.3	133.2	103.3
		F	151.8	166.4	130.8
French-Indian L.	Alewife	M	206.7	235.3	176.7
		F	230.4	268.1	202.5
Oromocto R.	Alewife	M	219.5	241.3	187.2
		F	257.4	282.3	212.6

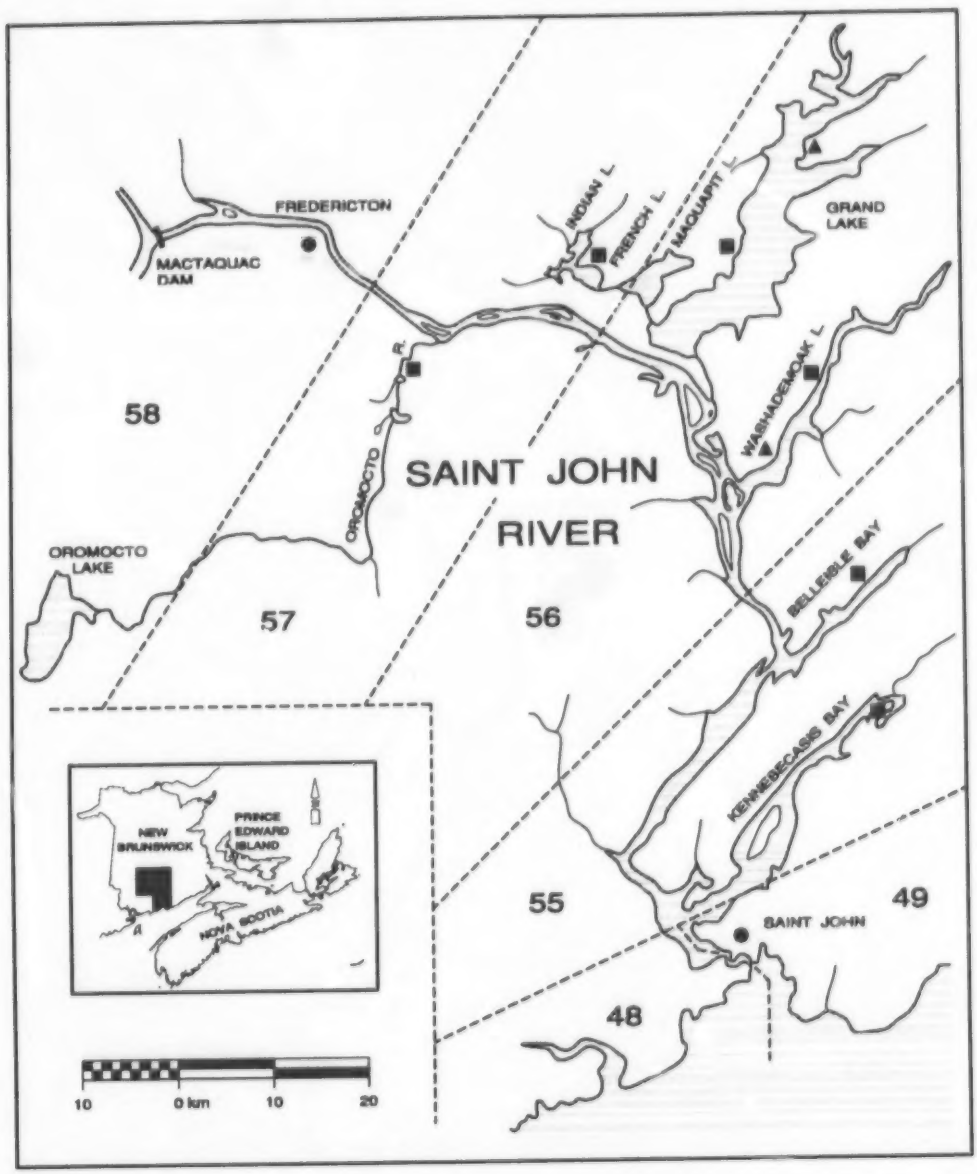

Figure 1. Map of the lower Saint John River, New Brunswick, with Fishery Statistical Districts numbered and sampling sites marked with a solid square or triangle (used occasionally, as described in text).

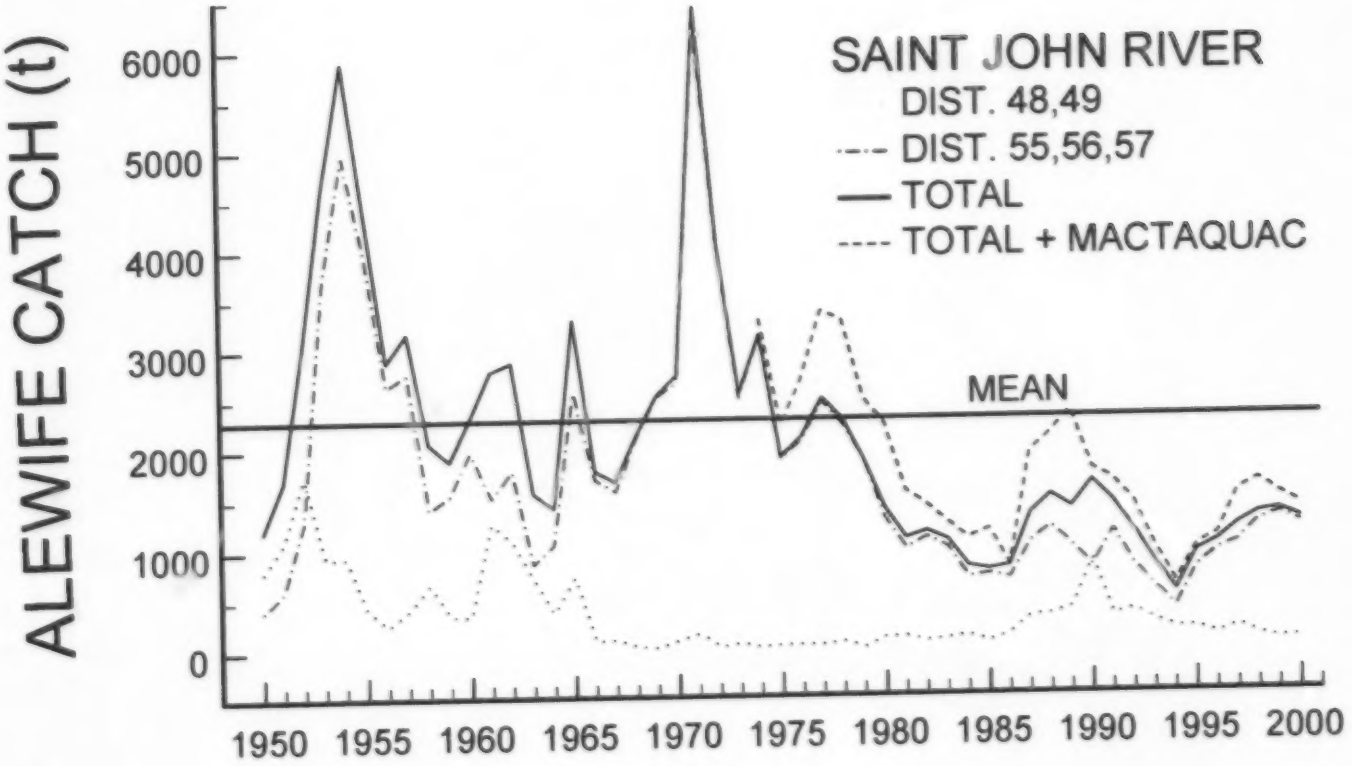

Figure 2. Annual reported catch (t) of alewives (alewives and blueback herring) in the Saint John River by geographic area: Saint John Harbour (FSDs 48-49), the tributary lakes and rivers (FSDs 55-57), and at the Mactaquac Dam, 1950-2000. The long-term mean catch, including Mactaquac Dam is 2,284 t and 2,087 t excluding Mactaquac Dam.

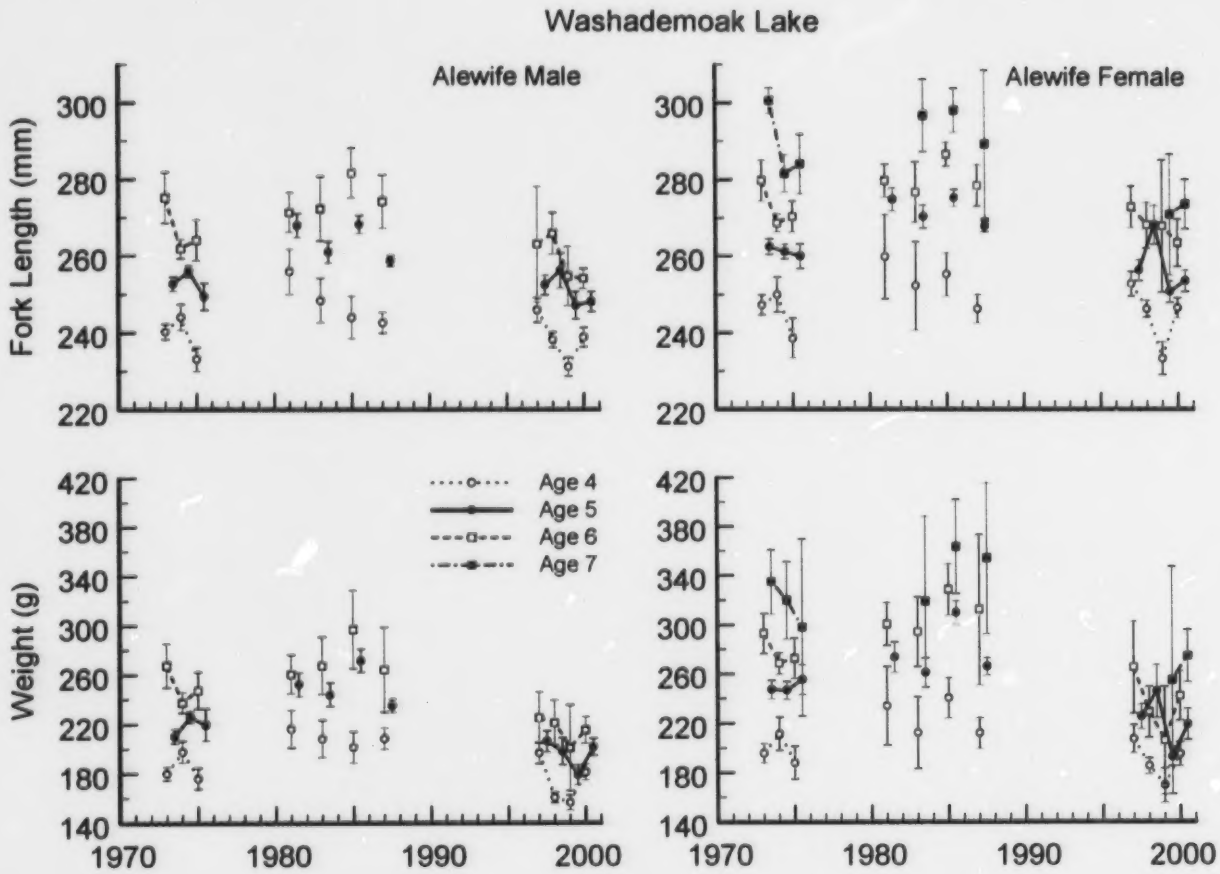

Figure 3. Annual mean sample lengths and weights with 95% confidence intervals, by age, of male and female alewives from Washademoak Lake, lower Saint John River, 1973-2000.

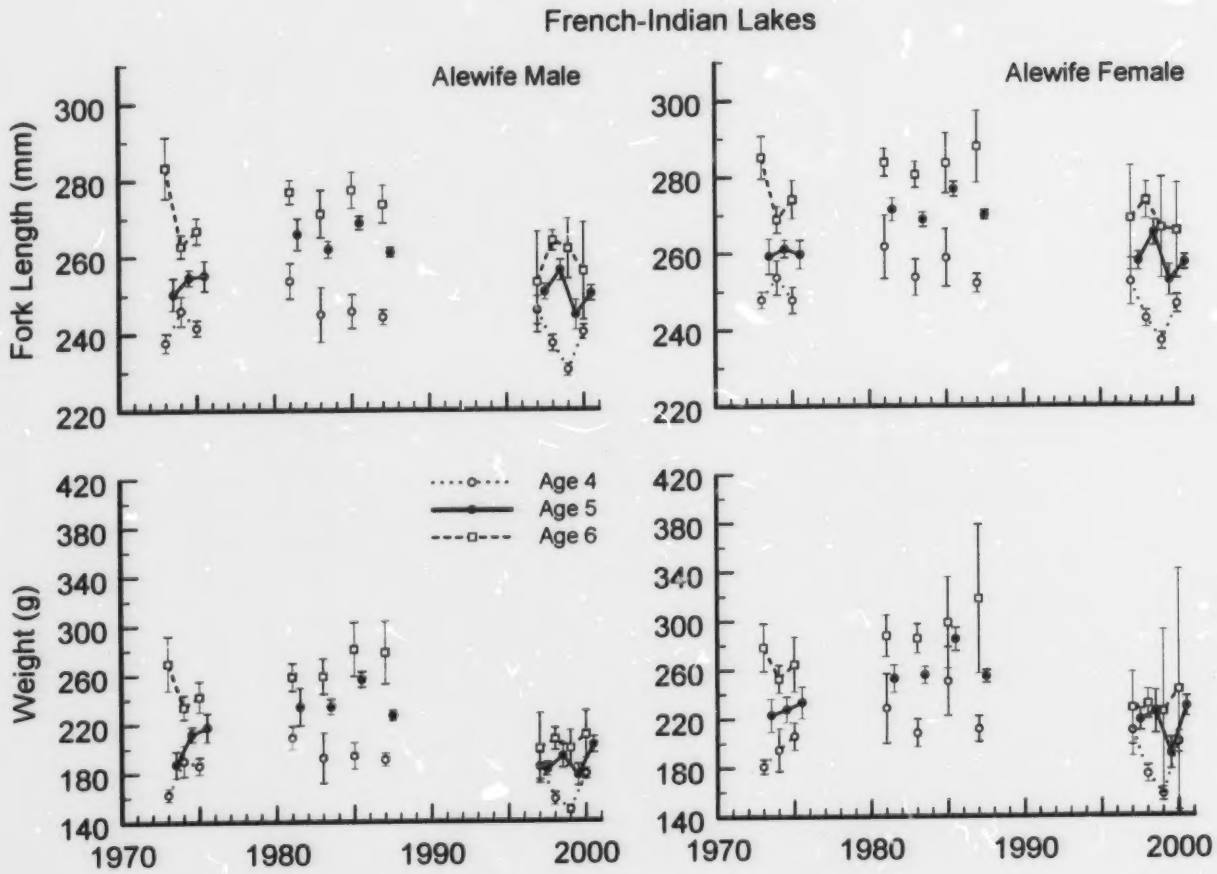

Figure 4. Annual mean sample lengths and weights with 95% confidence intervals, by age, of male and female alewives from French and Indian Lakes, lower Saint John River, 1973-2000.

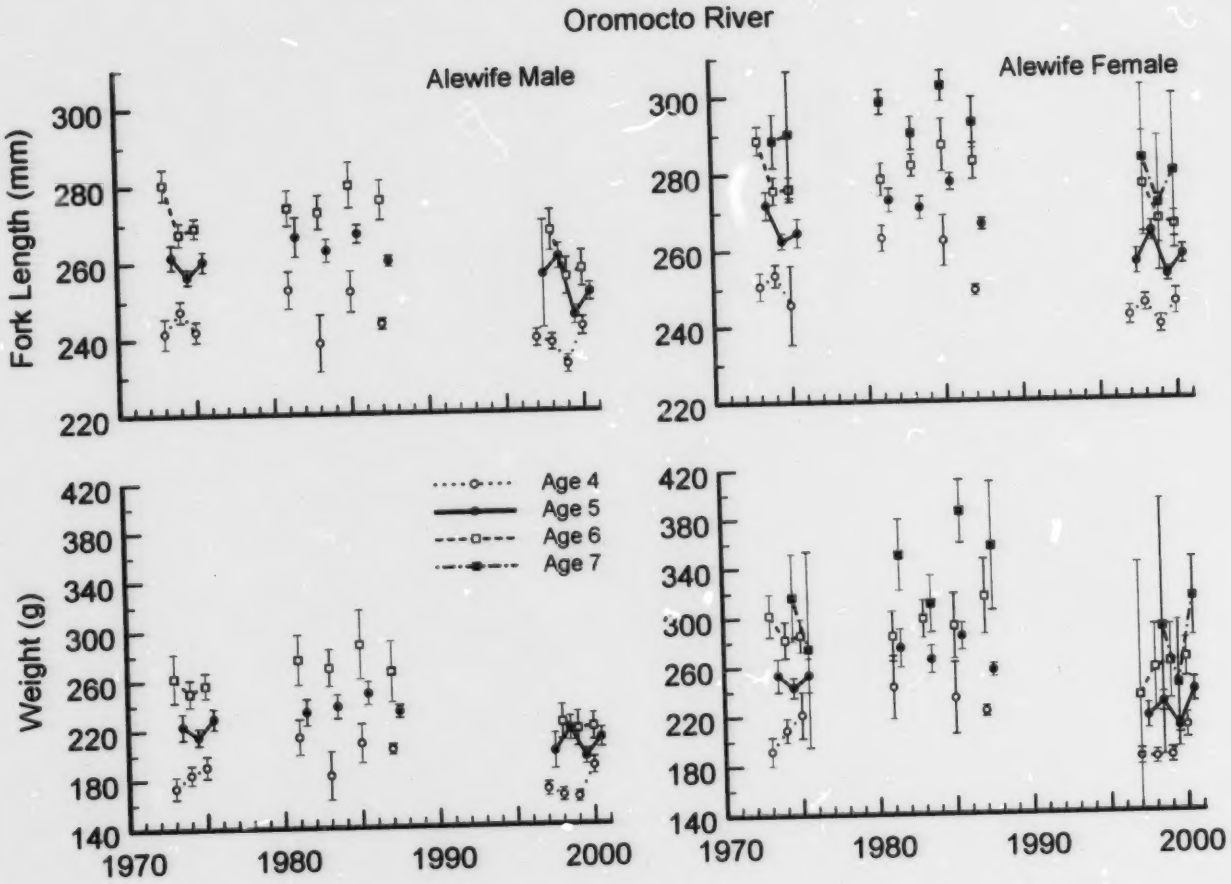

Figure 5. Annual mean sample lengths and weights with 95% confidence intervals, by age, of male and female alewives from the Oromocto River, lower Saint John River, 1973-2000.

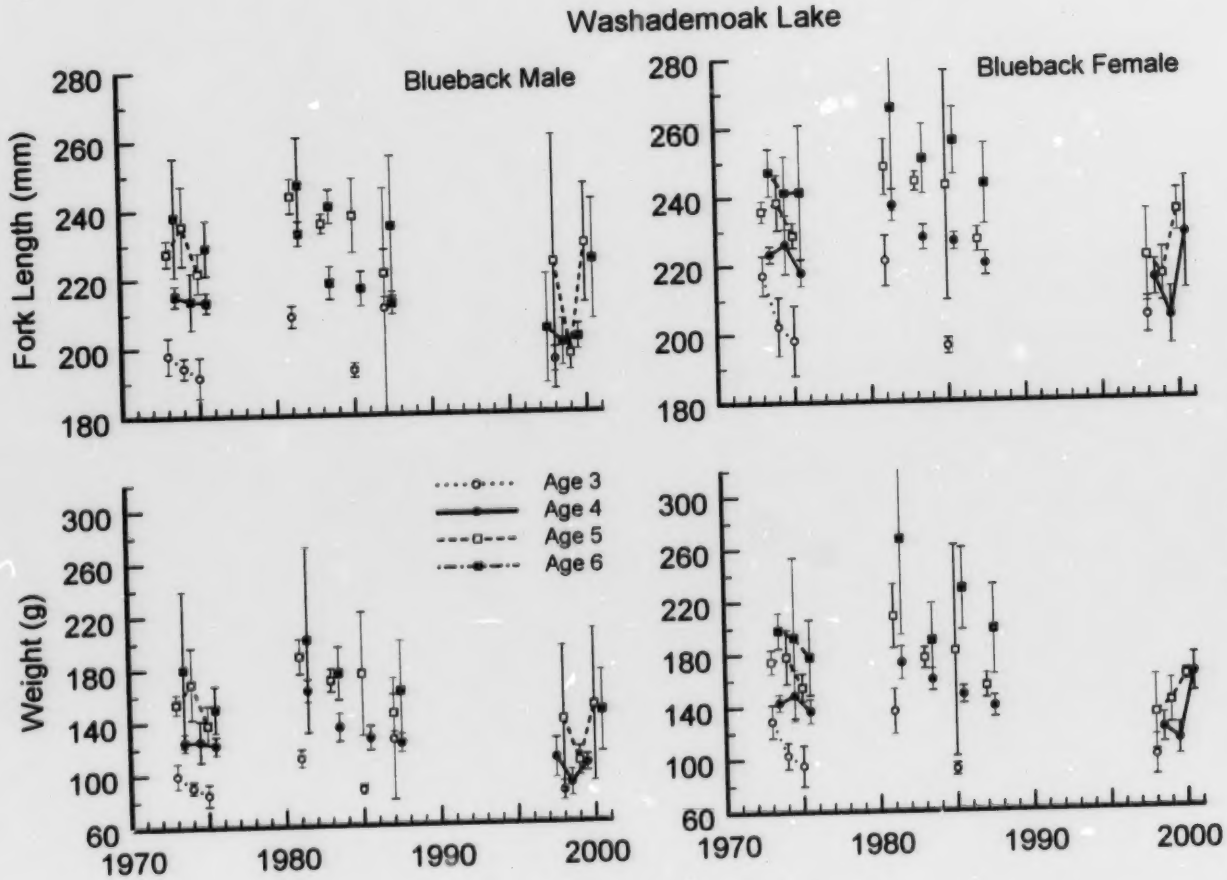

Figure 6. Annual mean sample lengths and weights with 95% confidence intervals, by age, of male and female blueback herring from Washademoak Lake, lower Saint John River, 1973-2000.

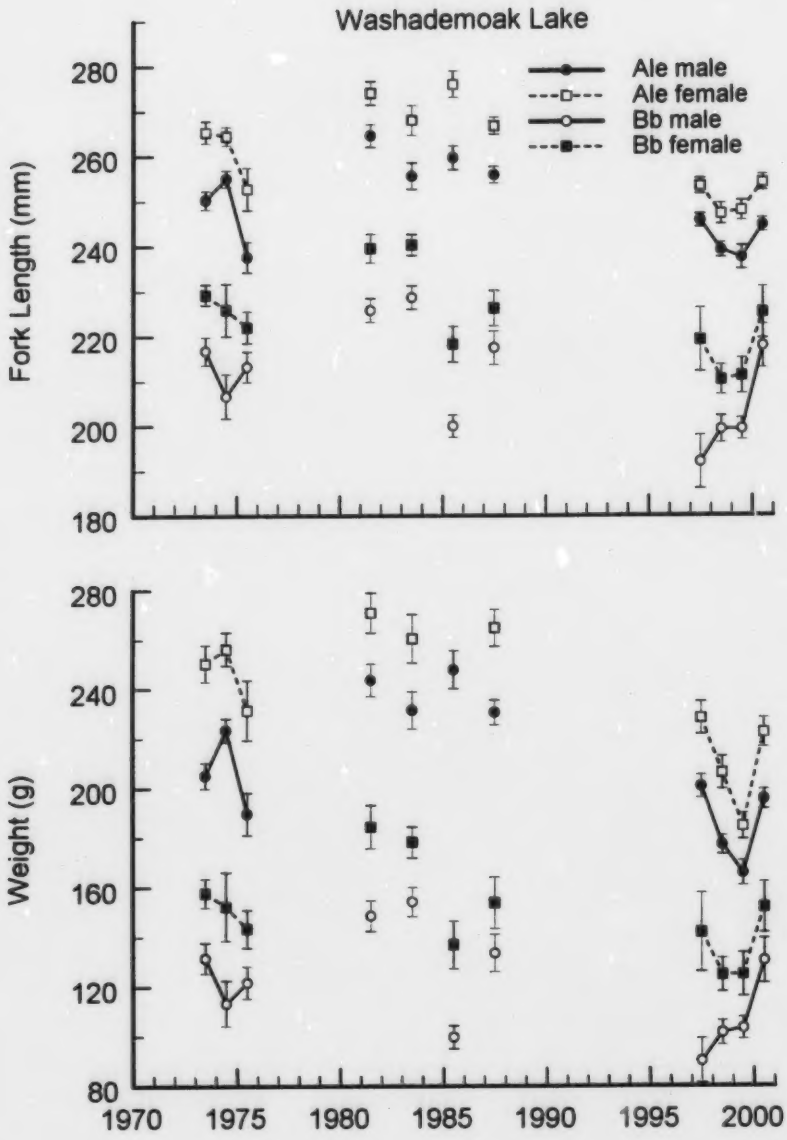

Figure 7. Annual mean lengths and weights of alewives and blueback herring, by sex, from Washademoak Lake, lower Saint John River, 1973-2000. Annual mean sample sizes for each sex ranged from 125-282 for alewives and 20-212 for blueback herring.

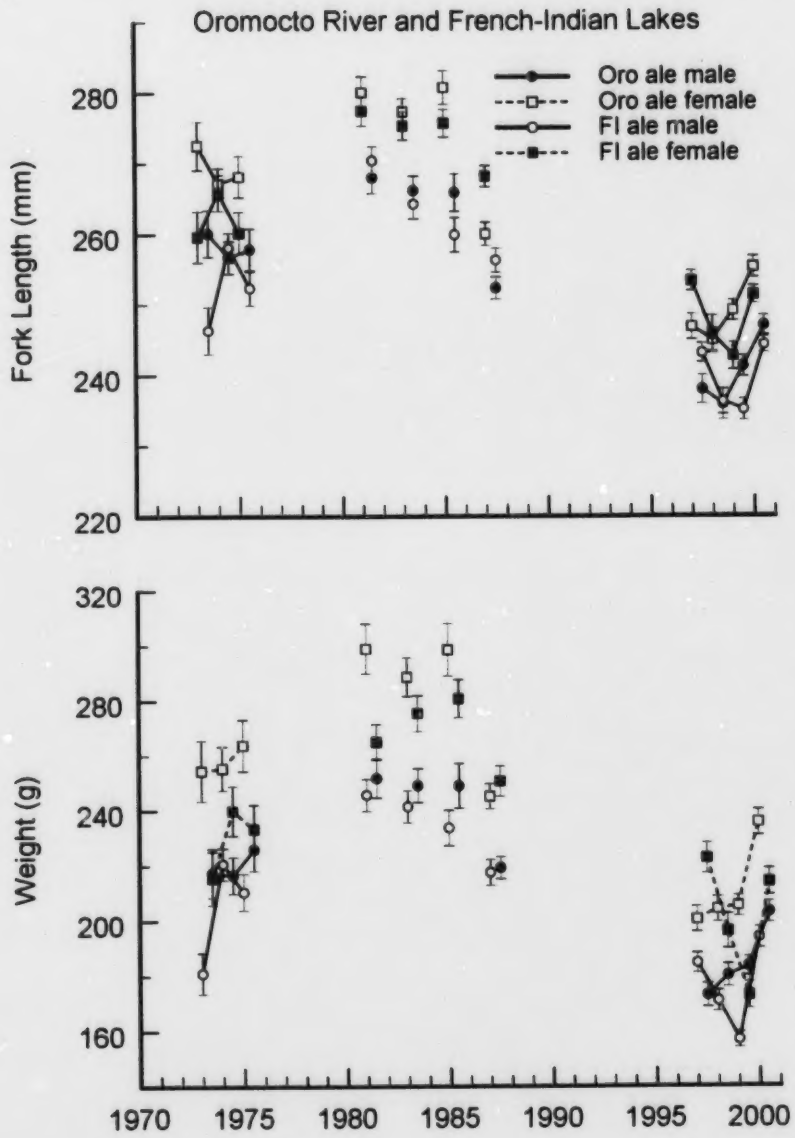

Figure 8. Annual mean lengths and weights of alewives and blueback herring, by sex, from the Oromocto River and French and Indian Lakes, lower Saint John River, 1973-2000. Annual mean sample sizes for each sex ranged from 114-357 for males and 101-311 for females.

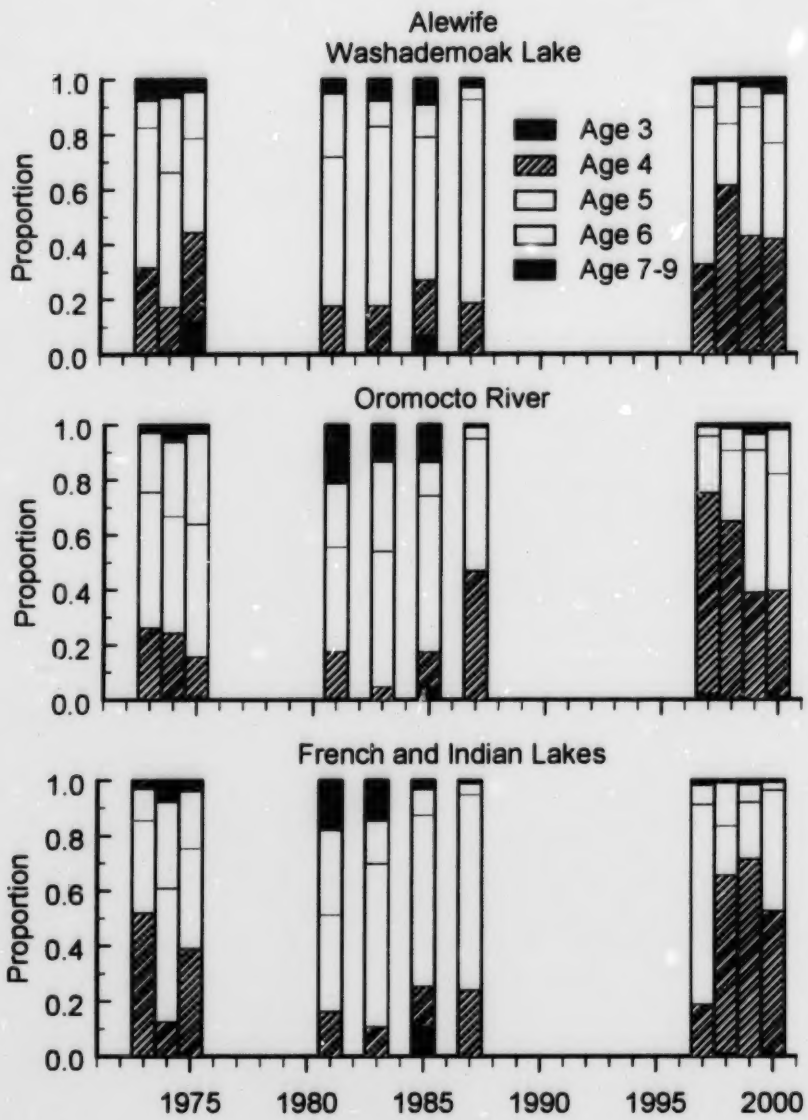

Figure 9. Age composition (proportion at age) of alewives from tributaries of the lower Saint John River, 1973-2000. Annual sample sizes range from 122-491 fish (median 249 fish).

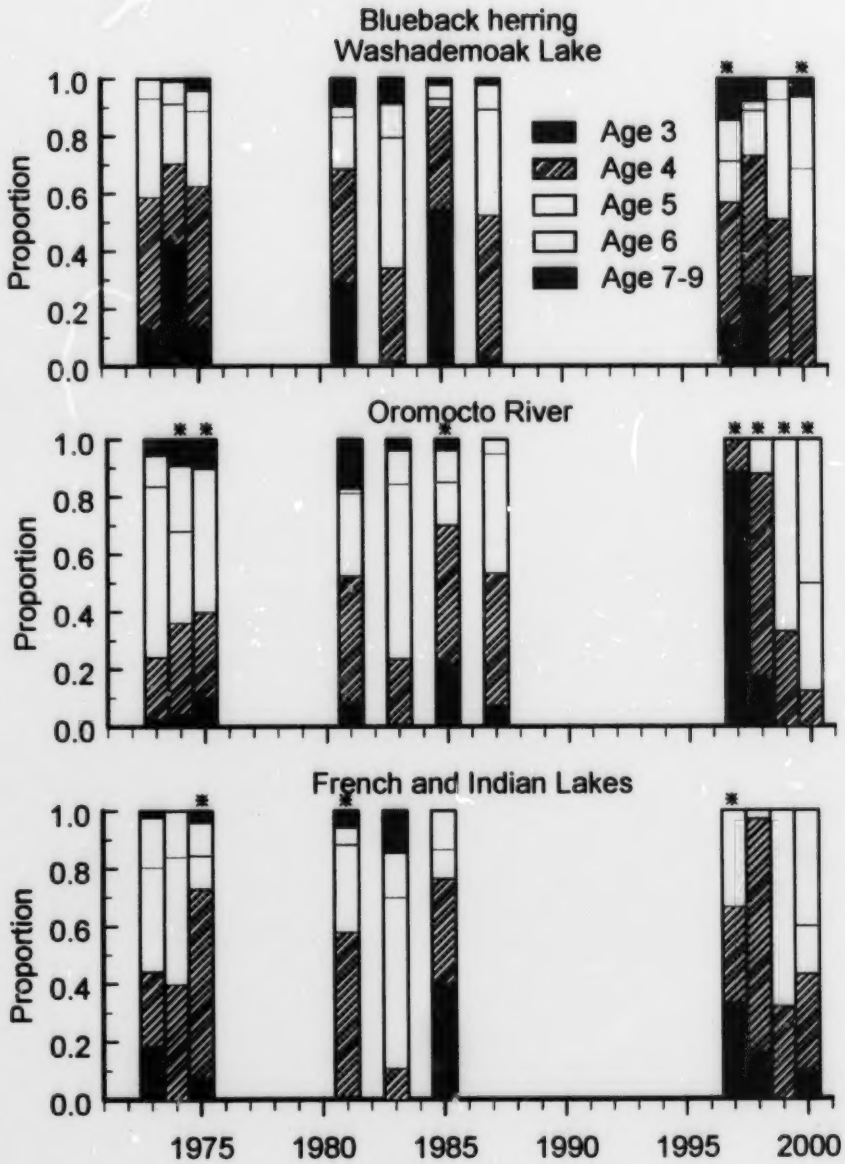

Figure 10. Age composition (proportion at age) of blueback herring from tributaries in the lower Saint John River, 1973-2000. Annual sample sizes range from 3-235 fish (median 37 fish); asterisks indicate sample sizes less than 30 fish.

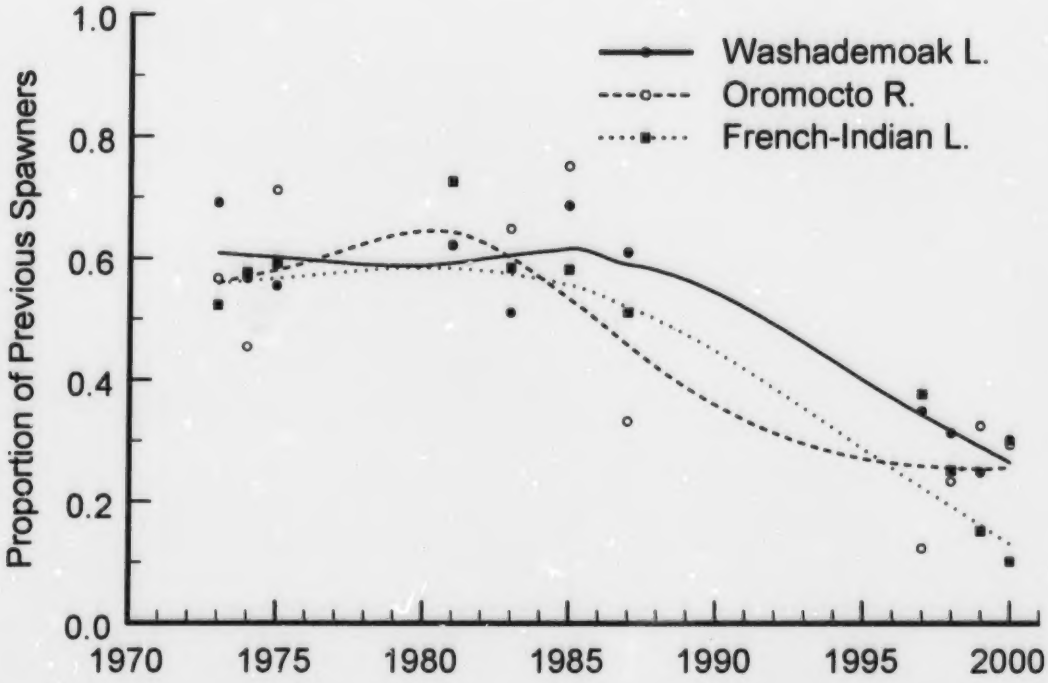

Figure 11. Proportion of previous spawning alewives in the trap-net fishery at several locations in the lower Saint John River, 1973-2000. The trend lines are LOWESS smoothers (span = 0.7).

Appendix 1. Annual mean lengths and weights at age, by sex and site, for alewives from the lower Saint John River, N.B., 1973-2000.

		Alewife									
		Male					Female				
			Length		Weight			Length		Weight	
Year	Age	n	(mm)	SD	(g)	SD	n	(mm)	SD	(g)	SD
						Washademoak Lake					
1973	3	4	207.8	8.96	125.5	9.15					
	4	84	240.3	9.21	180.2	24.85	69	247.3	10.83	195.9	32.12
	5	120	252.7	10.12	210.3	31.48	129	262.5	11.66	247.4	41.80
	6	18	275.2	14.24	267.4	35.34	30	279.8	14.84	292.9	43.28
	7	3	295.0	3.61	296.0	18.00	25	300.6	8.30	335.0	63.25
	8	1	294.0		310.0		7	305.0	7.23	341.7	41.50
	9						1	303.0		427.0	
	Total	230	249.9	15.95	203.8	40.59	261	265.4	20.29	250.6	61.49
1974	3	5	197.0	18.99	108.0	33.29	2	212.5	10.61	126.5	40.31
	4	48	244.1	11.24	197.7	29.93	27	250.0	11.40	211.4	34.09
	5	133	256.0	8.68	225.6	26.57	94	261.2	9.09	246.7	34.36
	6	59	261.8	9.76	237.4	30.94	67	268.7	9.60	268.7	35.75
	7	6	277.3	11.69	275.2	47.50	15	281.7	8.71	319.8	56.63
	8	3	295.7	5.13	317.0	48.28	6	306.7	8.96	352.5	40.40
	Total	254	254.9	14.99	223.0	37.93	211	264.4	14.99	256.3	48.91
1975	3	22	201.6	6.34	112.7	16.04	12	191.6	15.41	98.3	28.38
	4	61	233.1	12.28	176.0	33.69	29	238.6	13.59	188.2	34.83
	5	51	249.4	12.33	219.5	45.62	44	260.0	10.37	255.5	39.67
	6	17	264.1	10.40	247.3	29.13	30	270.4	10.62	272.6	44.32
	7	3	261.0	12.12	234.7	60.12	7	284.1	8.32	297.9	77.73
	8						2	291.5	14.85	279.0	46.67
	Total	154	238.0	21.36	190.4	54.11	124	252.8	26.84	231.5	68.93
1981	3	1	191.0		87.0		1	218.0		131.0	
	4	16	255.9	10.98	216.2	28.78	14	259.9	19.00	234.0	54.97
	5	45	268.0	10.25	252.0	31.52	52	274.9	10.76	273.6	43.70
	6	20	271.4	11.01	260.2	33.25	21	279.8	9.36	300.5	38.14
	7	4	278.3	4.19	278.8	15.65	2	292.0	5.66	401.0	79.20
	8						2	307.0	7.07	357.0	33.94
	9						1	300.0		285.0	
	Total	86	266.1	14.31	246.6	38.69	93	274.5	15.66	276.8	54.80
1983	3	1	226.0		174.0		1	212.0		123.0	
	4	21	248.4	12.80	208.2	33.02	12	252.3	18.17	212.3	45.54
	5	63	261.0	11.15	243.8	37.31	63	270.4	11.73	261.0	46.93
	6	8	272.4	10.07	267.3	27.72	10	276.8	10.98	294.2	39.56
	7	3	287.7	18.15	299.0	78.08	5	296.8	7.66	319.0	56.20
	8	2	294.5	6.36	327.5	3.54	2	305.0	4.24	401.5	17.68
	9	1	288.0		338.0		1	304.0		403.0	
	10						1	314.0		490.0	
	Total	99	260.7	15.35	241.7	44.40	95	271.1	17.89	266.8	62.80
1985	3	16	225.9	7.91	159.7	16.34	3	225.0	5.00	155.3	6.81
	4	27	244.0	13.80	201.3	31.97	27	255.3	14.14	240.6	41.26
	5	60	268.3	8.76	271.4	35.53	78	275.3	9.56	309.8	42.83
	6	9	281.7	8.47	296.8	41.08	23	286.7	7.13	328.8	48.16
	7	5	289.6	6.43	354.8	43.02	13	298.2	9.49	363.8	63.92
	8						3	307.7	9.29	384.7	86.80
	9	1	310.0		329.0		2	307.0	12.73	421.0	0.00
	Total	118	259.2	21.06	246.2	60.41	149	275.5	18.03	304.8	62.90

1987	4	42	242.6	8.53	208.4	27.80	23	246.3	8.66	211.9	28.31
	5	113	258.8	7.38	234.8	27.85	141	267.9	8.52	266.0	41.83
	6	8	274.3	8.38	264.0	41.05	7	278.6	5.86	312.4	66.07
	7	1	293.0		328.0		6	289.3	18.52	354.3	58.75
	8						2	296.0	9.90	353.5	7.78
	9	1	286.0		307.0						
	Total	165	255.8	11.82	230.5	32.89	179	266.6	12.85	264.8	50.30
1997	4	34	246.0	9.04	196.6	24.71	18	252.8	6.49	207.2	22.55
	5	45	252.5	8.78	206.0	28.00	45	256.4	9.08	225.5	33.21
	6	5	263.2	12.11	225.0	16.52	8	273.0	6.50	265.3	44.99
	7	2	271.5	9.19	285.0	0.00	1	275.0		305.0	
	Total	86	251.0	10.47	205.2	29.31	72	257.6	10.15	226.4	36.82
1998	4	81	238.2	8.86	160.4	18.62	54	246.3	7.92	185.3	23.53
	5	33	256.3	12.65	197.8	30.64	15	268.3	9.29	245.8	38.96
	6	17	266.0	10.50	220.9	35.38	16	268.2	11.31	229.0	38.76
	7	1	273.0		209.0		1	268.0		203.0	
	Total	132	246.6	14.91	178.1	33.68	86	254.5	13.77	204.5	38.93
1999	3	2	231.0	5.66	151.0	12.73					
	4	34	231.2	7.25	156.5	16.98	23	233.3	9.98	169.5	32.18
	5	25	247.2	8.74	178.8	18.94	39	250.8	8.69	192.6	23.85
	6	5	254.8	6.18	200.6	27.90	5	268.0	13.96	206.0	35.28
	7						4	271.0	9.90	255.0	58.21
	Total	66	239.0	11.69	168.2	23.10	71	247.5	14.88	189.6	35.39
2000	3	1	216.0		124.0						
	4	56	238.9	9.24	181.2	24.10	35	246.6	7.48	194.9	28.37
	5	41	248.2	8.08	201.4	22.41	35	253.6	8.18	219.0	36.95
	6	23	254.2	5.98	215.0	24.74	16	263.6	11.72	242.3	37.73
	7	1	260.0		218.0		9	273.7	8.40	274.7	27.55
	8						1	291.0		340.0	
	9						1	291.0		358.0	
	Total	122	244.9	10.61	194.2	27.57	97	255.4	13.01	222.0	44.62
						Grand Lake					
1973	3	1	220.0		126.0						
	4	55	239.9	8.57	174.8	21.94	55	246.1	12.32	193.3	41.71
	5	119	254.6	10.75	211.9	33.86	82	263.1	11.64	236.3	40.65
	6	28	268.3	14.13	245.4	40.49	52	283.2	11.31	281.0	41.27
	7	7	276.7	22.61	264.7	41.65	12	289.0	15.93	315.4	74.10
	8	4	290.8	8.38	300.0	52.04	8	303.4	10.13	331.8	58.19
	9	1	283.0		286.0						
	Total	215	254.0	15.87	210.1	42.90	209	266.7	20.15	244.3	59.60
1974	3	1	210.0		122.0		2	196.0	2.83	93.5	2.12
	4	103	246.6	8.95	189.4	24.03	48	251.3	11.54	204.3	33.62
	5	123	253.5	8.17	211.0	25.54	103	260.7	9.59	230.7	32.66
	6	53	264.8	10.98	238.3	28.52	73	273.8	11.52	266.0	38.82
	7	10	284.2	9.00	286.6	45.90	9	285.0	12.42	280.6	41.52
	8	3	293.0	11.00	332.0	20.66	10	296.8	18.27	342.7	73.67
	Total	293	254.4	13.22	211.8	36.87	245	264.6	16.83	241.3	50.21
1981	4	5	254.4	14.88	197.2	24.59	3	255.3	8.02	218.3	13.65
	5	44	271.7	7.31	261.5	23.75	38	275.3	8.07	271.7	31.88
	6	31	273.2	8.43	266.5	33.58	32	283.5	10.69	299.8	42.82
	7	20	280.4	7.46	284.4	23.36	14	288.6	8.20	312.3	38.43
	8	11	286.7	5.00	295.7	21.62	13	293.3	7.75	323.6	42.76
	9	5	291.2	11.50	306.8	27.26	6	304.5	9.22	375.0	83.32
	10						4	302.3	8.10	338.0	63.70

	Total	116	275.1	10.74	269.2	33.20	110	283.6	13.16	297.8	50.83
1983	3	1	230.0		176.0		2	196.5	0.71	104.5	2.12
	4	19	248.8	12.95	206.8	42.11	8	254.6	15.64	222.0	38.77
	5	71	264.0	9.46	245.7	33.13	46	269.4	9.86	270.2	51.97
	6	33	269.5	8.90	266.0	26.27	26	275.0	11.36	288.3	55.09
	7	15	283.9	13.17	308.4	40.59	12	295.3	12.58	356.5	56.57
	8	16	289.2	12.21	325.0	51.61	15	299.7	9.45	387.9	64.20
	9	8	287.8	12.69	308.1	53.49	7	308.4	6.50	427.3	49.25
	10	2	299.5	6.36	356.0	49.50	3	304.3	8.96	416.7	96.10
	Total	165	269.0	16.23	262.6	51.28	119	278.0	21.23	304.6	82.81
1985	3	2	216.0	1.41	134.5	6.36					
	4	6	252.5	4.23	212.7	13.57	1	265.0		215.0	
	5	25	268.3	7.32	260.1	28.13	19	276.4	7.10	275.3	29.63
	6	7	281.1	8.01	292.0	27.92	9	289.2	5.56	307.8	33.07
	7	1	292.0		332.0		6	298.5	10.88	346.8	16.28
	8	1	285.0		253.0		3	309.0	8.54	369.7	8.50
	9						1	317.0		436.0	
	10						1	309.0		390.0	
	11						1	315.0		431.0	
	Total	42	266.6	16.09	254.2	44.33	41	287.3	14.96	308.8	53.31
1987	3	1	218.0		156.0						
	4	79	242.2	7.82	190.5	23.00	57	248.1	7.21	202.9	27.45
	5	104	259.1	8.97	226.5	29.92	108	267.8	7.76	251.9	33.18
	6	17	269.6	7.41	256.3	21.09	9	281.7	7.65	286.1	49.91
	7	4	281.8	7.68	312.3	36.99	1	297.0		267.0	
	8	1	288.0		308.0		3	308.0	13.75	317.0	50.41
	10						1	320.0		474.0	
	Total	206	253.9	13.54	216.9	37.24	179	263.3	14.79	240.5	45.67
						Oromocto River					
1973	3	1	230.0		147.0						
	4	33	241.6	11.21	173.5	25.51	24	250.7	8.57	191.8	27.56
	5	56	261.6	12.08	223.0	39.05	52	271.9	12.92	253.2	47.88
	6	19	280.5	8.21	262.3	40.68	28	288.8	9.37	301.7	44.64
	7	1	285.0		263.0		2	293.5	9.19	296.0	25.46
	8	3	294.7	4.16	308.0	50.11					
	Total	113	259.7	18.34	217.1	49.54	106	272.0	17.56	252.9	57.63
1974	3	4	199.5	23.16	108.0	36.53					
	4	52	247.4	10.19	184.1	27.32	34	253.6	8.23	208.8	27.32
	5	79	256.5	9.08	214.7	30.51	76	262.6	8.91	243.3	34.89
	6	45	267.6	9.60	249.9	35.82	54	275.7	12.87	281.9	53.66
	7	7	280.6	12.37	302.1	47.57	11	288.6	10.28	316.2	52.42
	8	1	305.0		313.0		2	303.0	14.14	370.5	68.59
	9						1	303.0		405.0	
	Total	188	256.6	15.94	216.2	46.11	178	267.2	14.82	255.3	53.83
1975	3	6	209.0	9.76	116.0	16.57					
	4	25	242.0	6.59	190.2	21.43	9	245.7	13.51	221.0	24.35
	5	59	260.4	10.12	229.1	33.14	53	264.7	13.60	253.3	50.15
	6	36	269.2	7.34	256.1	29.73	40	276.1	10.06	285.3	41.54
	7	4	280.3	7.09	282.0	32.69	3	290.3	6.66	274.3	31.97
	Total	130	257.5	16.96	225.5	44.94	105	268.1	15.28	263.3	48.63

1981	3	1	237.0		191.0		1	216.0		144.0	
	4	17	252.8	9.55	213.5	27.97	23	263.1	7.78	242.9	58.85
	5	44	266.6	16.90	233.5	34.25	45	273.0	10.06	274.4	51.05
	6	24	274.2	10.89	276.1	47.50	30	278.5	11.25	283.9	53.81
	7	10	284.4	5.44	307.6	32.66	23	298.5	7.41	350.3	66.89
	8	3	291.3	5.69	326.0	54.74	13	302.6	7.56	377.5	53.74
	9						1	306.0		298.0	
	Total	99	268.3	16.59	250.2	49.01	136	279.5	17.09	293.1	70.66
1983	4	10	238.7	10.54	182.1	27.07	2	233.5	16.26	188.5	50.20
	5	54	263.0	11.05	237.9	35.42	69	271.0	11.87	265.1	46.30
	6	29	273.0	11.60	269.2	39.03	52	282.0	10.51	298.0	53.90
	7	5	288.0	10.46	301.8	44.49	12	290.3	6.75	310.4	36.35
	8	2	289.0	5.66	347.5	77.07	9	298.1	7.29	357.6	60.56
	9	2	288.0	5.66	303.5	20.51	3	307.0	12.29	415.3	115.76
	Total	102	265.7	15.90	247.9	47.97	147	278.4	15.00	288.1	60.06
1985	3	8	227.9	6.79	149.0	14.72					
	4	13	252.2	8.91	208.0	26.18	8	262.3	7.92	233.6	34.79
	5	48	267.2	8.19	248.3	32.20	45	277.6	7.31	283.5	36.27
	6	10	280.0	8.29	287.8	38.66	10	287.2	9.48	291.9	36.79
	7	5	295.0	10.75	345.4	59.57	14	302.6	6.87	385.4	44.56
	8						2	308.5	4.95	416.0	32.53
	9						1	326.0		553.0	
	Total	84	264.3	17.56	243.1	54.50	80	283.0	14.98	304.1	66.10
1987	4	116	243.6	7.39	202.7	22.19	96	249.1	7.00	222.7	21.11
	5	93	260.0	6.96	233.4	24.96	123	266.5	8.24	256.0	28.38
	6	11	276.0	7.75	265.6	36.61	7	283.0	5.10	315.6	33.07
	7	1	270.0		280.0		3	293.0	2.65	356.7	21.08
	Total	221	252.2	12.10	219.1	30.55	229	260.0	12.69	245.2	35.22
1997	3	3	215.0	38.97	124.3	63.54					
	4	46	239.2	7.61	168.6	18.14	43	242.0	8.18	184.0	20.70
	5	5	256.0	11.37	199.2	11.63	20	256.1	7.05	216.8	21.73
	6	2	260.0	0.00	206.5	12.02	2	268.5	4.95	233.5	12.02
	7						1	270.0		287.0	
	Total	56	240.1	13.59	170.3	25.88	66	247.5	11.04	197.0	28.54
1998	3	1	225.0		123.0		1	226.0		154.0	
	4	89	238.0	9.80	163.6	24.26	82	245.2	9.86	183.6	24.92
	5	23	260.6	7.67	217.3	22.69	45	264.1	8.59	227.9	26.96
	6	14	267.4	9.25	222.6	23.90	7	276.5	14.76	255.9	38.05
	7						4	283.2	12.04	289.0	65.53
	Total	127	245.2	14.96	179.5	35.08	139	253.9	15.12	204.4	39.36
1999	3	1	220.0		130.0						
	4	53	232.2	8.21	161.9	16.08	59	239.5	8.94	184.5	23.53
	5	72	245.1	10.41	194.3	26.14	78	252.7	8.59	208.4	24.84
	6	11	255.3	7.14	216.9	20.91	6	267.3	6.09	260.5	28.86
	7	6	259.5	5.96	226.5	26.34	4	271.3	11.09	242.8	32.19
	Total	143	241.5	12.41	185.0	30.12	147	248.5	12.05	201.9	30.43
2000	3	4	226.3	13.20	197.8	9.74					
	4	60	242.2	9.21	187.0	26.50	47	245.5	11.46	208.5	34.49
	5	59	251.2	8.79	209.7	30.03	59	257.9	9.14	237.5	37.41
	6	20	257.3	10.05	218.6	23.16	25	265.8	8.22	263.8	37.87
	7	2	281.0	0.00	312.5	47.38	3	279.7	8.14	313.3	12.86
	Total	145	248.0	11.89	202.6	32.65	134	255.5	12.90	233.9	42.75

French and Indian Lakes

1973	3	1	204.0		116.0						
	4	64	237.8	9.62	162.6	19.92	44	247.9	7.02	181.1	19.19
	5	34	250.4	11.63	187.4	30.70	36	259.3	13.71	222.9	39.57
	6	9	283.4	10.47	269.7	28.79	15	285.2	11.01	278.3	35.18
	7	2	283.5	4.95	251.0	26.87	3	289.7	11.50	277.3	36.94
	9	1	294.0		244.0						
	Total	111	246.4	17.99	180.8	39.91	98	259.1	17.34	214.3	47.08
1974	3	1	213.0		127.0						
	4	20	246.0	8.20	190.4	26.83	16	253.7	8.44	194.8	32.87
	5	87	254.7	9.33	211.9	27.79	52	261.3	8.17	227.6	36.67
	6	47	262.9	10.22	233.8	33.33	43	268.9	11.24	252.7	36.33
	7	8	286.9	11.96	294.5	26.01	9	283.1	20.95	288.0	85.51
	8	2	291.0	5.66	306.5	4.95	1	307.0		390.0	
	9						2	309.5	14.85	342.5	37.48
	Total	165	257.7	13.62	220.2	37.95	123	265.7	14.47	239.7	50.57
1975	4	69	241.6	8.45	186.1	28.47	37	247.8	10.15	205.9	33.57
	5	45	255.2	13.11	217.2	38.49	52	259.8	13.23	233.3	45.53
	6	34	266.9	9.65	242.3	35.66	22	274.2	11.18	264.7	50.24
	7	3	279.3	12.70	261.7	37.82	5	284.6	12.60	278.8	32.61
	8	1	271.0		313.0						
	9						1	302.0		326.0	
	Total	152	252.3	14.98	210.2	41.57	117	260.1	16.25	233.3	48.42
1981	4	25	253.8	11.26	208.5	22.67	11	261.7	12.33	228.2	42.22
	5	29	266.0	10.85	233.7	40.19	47	271.5	10.26	252.6	37.41
	6	31	277.0	8.43	258.0	30.16	36	283.8	10.75	287.6	50.48
	7	9	287.4	10.45	288.1	37.06	13	290.8	9.32	298.2	34.96
	8	6	289.8	3.49	303.3	16.52	6	299.7	5.75	311.7	34.24
	9	2	283.5	4.95	282.5	31.82	2	305.0	9.90	309.5	4.95
	10						1	304.0		321.0	
	Total	102	270.0	15.23	244.8	42.28	116	278.9	14.70	270.9	47.81
1983	4	9	245.0	9.30	192.0	26.39	18	253.7	9.41	208.2	22.45
	5	72	262.0	9.51	233.7	25.86	74	268.8	8.17	255.5	30.32
	6	13	271.3	10.20	258.3	23.87	25	280.6	8.16	285.4	28.66
	7	4	272.8	7.93	267.3	38.74	11	294.1	8.97	337.8	43.09
	8	5	299.8	11.84	353.6	57.46	7	303.0	12.58	373.6	48.91
	9	3	293.3	1.15	308.0	21.66	2	312.5	13.44	429.0	29.70
	10						2	318.0	7.07	440.5	19.09
	11	1	322.0		487.0		1	313.0		430.0	
	Total	107	265.3	15.61	244.5	48.24	140	274.3	16.78	273.5	58.65
1985	3	26	227.7	8.11	156.1	15.88	2	233.5	7.78	175.5	7.78
	4	25	245.8	10.75	193.6	25.72	12	258.8	11.78	250.2	44.10
	5	82	268.9	7.79	256.0	28.59	76	276.8	8.34	284.7	41.63
	6	13	277.5	7.75	280.4	36.54	11	283.6	11.70	298.3	55.68
	7						5	304.4	8.23	369.0	38.79
	8	2	297.5	17.68	354.0	96.17					
	10						1	322.0		396.0	
	Total	148	258.9	19.43	231.3	52.66	107	276.4	14.55	285.2	51.08
1987	4	61	244.3	7.26	190.5	19.79	34	252.1	6.94	211.3	29.90
	5	106	261.3	6.46	226.1	21.52	173	270.0	7.93	254.2	33.75
	6	9	273.8	6.48	277.6	33.46	7	287.9	10.14	317.7	65.71
	7	2	280.0	0.00	307.0	18.38	2	302.5	4.95	377.0	59.40
	Total	178	256.3	11.45	217.4	32.08	216	268.1	11.30	250.7	41.66

1997	4	21	246.0	8.11	184.2	23.79	12	252.4	9.64	209.4	32.52
	5	67	250.8	8.27	182.0	22.31	59	257.8	9.08	218.0	33.94
	6	5	253.4	10.64	199.0	22.93	7	269.1	14.85	227.7	31.99
	7	1	273.0		246.0		1	260.0		186.0	
	8						1	302.0		403.0	
	Total	94	250.1	8.83	184.1	23.54	80	258.6	11.41	219.5	39.17
1998	3	2	210.0	13.63	110.5	20.51	1	212.0		132.0	
	4	93	237.4	10.03	157.8	24.26	57	242.7	8.12	173.8	26.84
	5	26	256.5	6.80	192.6	22.88	15	265.2	6.04	224.4	31.64
	6	24	264.2	6.04	206.7	21.30	12	273.7	7.62	230.9	19.00
	7						2	279.4	1.43	251.5	2.12
	Total	145	244.9	14.80	171.6	31.68	87	251.3	15.65	191.7	37.65
1999	4	118	230.4	8.55	149.2	16.93	66	236.8	8.88	157.2	21.80
	5	31	244.8	10.70	177.1	24.04	22	252.7	8.99	190.5	28.79
	6	10	262.1	11.07	199.0	20.60	6	266.5	12.57	224.7	63.67
	7	3	265.0	8.66	213.3	17.79	1	272.0		217.0	
	Total	162	235.8	13.33	158.8	25.13	95	242.7	13.21	169.8	34.02
2000	3	3	242.0	8.89	169.7	34.85	1	237.0		176.0	
	4	98	240.3	9.50	178.3	21.92	64	246.5	9.54	199.7	35.39
	5	72	250.4	8.38	202.0	28.02	65	257.4	7.61	228.8	33.56
	6	6	256.2	12.11	210.3	18.44	3	265.7	5.03	242.7	39.70
	7	1	281.0		265.0		1	257.0		235.0	
	Total	180	245.1	10.81	189.2	27.92	134	252.2	10.31	214.8	37.36
						Belleisle Bay					
1974	3	1	208.0		125.0		1	190.0		87.0	
	4	15	247.2	7.68	196.3	22.97	4	247.5	9.57	219.0	18.38
	5	36	258.9	9.12	222.9	32.41	20	265.1	10.28	235.2	39.69
	6	17	271.5	10.15	241.4	26.85	20	273.8	15.37	267.7	49.57
	7	2	289.5	3.54	310.5	10.61	3	285.7	11.02	322.7	33.98
	8						4	290.8	27.42	326.8	96.83
	Total	71	259.6	14.44	222.8	37.25	52	268.8	20.22	255.7	60.53
						Kennebecasis Bay					
1974	4	8	238.9	10.51	182.0	19.21	5	247.2	11.12	196.6	35.22
	5	59	259.2	11.88	218.3	27.25	61	264.3	12.64	238.2	33.43
	6	29	270.5	13.33	249.5	37.54	39	274.7	16.39	264.9	39.91
	7	15	283.7	12.41	286.0	27.42	14	290.4	23.91	301.2	63.64
	8	9	283.0	18.32	283.4	40.31	12	301.2	12.66	324.8	57.67
	Total	120	265.4	17.21	236.8	42.35	131	272.9	19.86	259.2	51.59
1975	4	19	241.8	6.53	202.5	33.65	11	243.2	5.67	201.7	21.77
	5	17	252.3	13.39	211.7	24.29	5	249.4	9.76	219.6	18.70
	6	13	268.8	7.35	257.5	29.60	7	278.9	19.30	301.1	86.72
	7	3	273.7	9.81	269.3	37.00	3	289.0	7.00	313.0	110.53
	8	2	280.5	28.99	283.0	65.05					
	9						2	318.0	0.00	412.0	9.90
	Total	54	254.8	16.00	225.3	40.34	28	263.5	25.90	256.7	83.33
1981	4	3	255.3	6.81	201.3	6.11	2	249.5	6.36	191.0	21.21
	5	12	265.2	7.90	226.3	23.80	8	272.0	10.34	254.4	28.21
	6	12	273.8	9.70	248.4	28.51	3	287.0	2.65	290.3	18.90
	7	2	286.0	11.31	279.0	74.95	5	298.6	13.03	304.0	35.16
	8	6	287.0	2.83	284.8	31.20	12	299.4	9.66	326.2	34.76
	9	3	291.7	4.73	307.3	16.29	2	302.0	7.07	362.0	8.49
	10						2	302.5	3.54	325.0	26.87
	Total	38	273.8	12.99	249.7	39.93	34	289.1	17.82	296.9	50.26

Appendix 2. Annual mean lengths and weights at age, by sex and site, for blueback herring from the lower Saint John River, N.B., 1973-2000.

		Blueback									
		Male					Female				
			Length		Weight			Length		Weight	
Year	Age	n	(mm)	SD	(g)	SD	n	(mm)	SD	(g)	SD
						Washademoak Lake					
1973	3	16	197.9	9.95	99.4	17.81	9	217.1	7.37	129.1	16.27
	4	37	215.1	9.02	124.8	19.83	53	223.3	8.83	143.2	22.38
	5	30	227.6	9.82	153.8	19.68	37	235.8	9.18	174.4	26.87
	6	3	238.0	6.93	180.0	23.81	10	247.2	9.50	198.2	18.81
	Total	86	217.1	14.53	132.1	28.99	109	229.2	12.30	157.7	30.80
1974	3	33	194.2	8.37	90.5	12.95	12	202.2	13.31	102.8	15.78
	4	16	213.6	15.37	125.1	29.32	14	226.1	14.65	148.6	33.36
	5	8	235.5	13.73	169.1	32.43	14	238.4	14.03	178.0	35.39
	6	2	237.0	4.24	165.5	4.95	6	241.2	10.07	192.5	58.27
	7						1	238.0		197.0	
	Total	59	206.5	19.28	113.1	36.05	47	225.8	19.94	152.3	46.85
1975	3	13	191.4	9.83	84.5	13.85	8	198.1	12.25	95.0	18.52
	4	39	213.2	9.01	121.9	20.85	36	217.8	11.30	136.5	26.76
	5	16	221.8	10.86	137.5	27.73	24	228.8	8.51	154.8	24.97
	6	6	229.0	7.62	149.5	16.78	5	241.4	15.63	177.4	23.03
	7	2	238.5	4.95	149.5	4.95	3	238.3	7.64	169.3	21.13
	8						1	264.0		264.0	
	Total	76	213.2	14.82	121.7	28.27	77	222.1	15.84	143.5	34.55
1981	3	38	208.8	9.39	111.3	19.76	10	221.1	10.39	135.9	23.76
	4	39	232.9	10.69	162.3	26.37	28	237.3	11.86	172.8	32.01
	5	17	243.8	9.67	188.4	25.87	13	248.5	13.41	208.4	39.98
	6	3	247.0	5.57	201.0	28.21	3	265.7	12.06	267.0	29.21
	7	5	263.6	6.35	247.0	33.41	4	267.8	7.41	244.8	57.35
	8	2	248.5	12.02	217.5	17.68	3	275.7	13.65	263.0	84.72
	9	2	266.0	4.24	269.0	0.00					
	Total	106	228.8	19.48	156.3	47.18	61	242.3	18.72	188.1	52.50
1983	3	2	204.0	1.41	99.5	7.78	2	204.5	6.36	112.0	8.49
	4	31	218.5	13.05	134.3	28.68	29	227.8	9.58	159.6	21.75
	5	38	235.7	8.61	170.1	26.12	47	244.2	9.60	176.3	26.81
	6	10	240.7	6.67	175.4	27.93	12	250.8	15.90	189.5	44.72
	7	4	253.3	13.28	216.5	33.76	6	266.7	9.91	233.8	31.31
	8	1	267.0		268.0		3	274.0	5.29	293.7	34.03
	9						2	282.0	5.66	310.0	74.95
	Total	86	230.5	15.40	159.5	37.41	101	242.5	17.31	181.3	44.05
1985	3	75	193.1	8.50	87.2	14.92	54	196.1	8.48	91.3	16.02
	4	24	216.7	11.78	126.0	21.44	59	226.6	9.76	148.0	24.98
	5	4	238.0	6.78	174.8	29.41	3	243.0	13.45	181.7	32.35
	6	2	253.0	7.07	204.5	72.83	9	255.9	12.69	228.7	40.60
	7	1	264.0		264.0		3	275.0	8.72	310.7	33.55
	8						1	280.0		315.0	
	Total	106	202.0	18.00	103.2	35.67	129	217.8	23.35	135.8	55.25
1987	3	3	211.0	14.00	125.0	18.52					
	4	22	212.4	7.11	121.9	15.88	25	220.0	8.33	138.8	19.33
	5	15	221.1	12.55	144.7	25.27	20	227.0	7.78	154.7	20.18
	6	4	234.8	12.82	161.3	24.02	4	243.3	7.41	197.5	21.38
	7	1	238.0		180.0						
	9						1	294.0		343.0	
	Total	45	217.8	12.29	134.5	24.75	50	226.1	14.08	153.9	37.03

1997	3	1	200.0		97.0		1	215.0		143.0	
	4	4	204.3	9.95	108.5	15.29	2	223.5	4.95	134.0	22.63
	5						2	231.0	8.49	161.5	24.75
	6	1	225.0		148.0		1	240.0		196.0	
	7						1	240.0		198.0	
	8						1	262.0		238.0	
	Total	6	207.0	11.83	113.2	21.27	8	233.3	14.87	170.8	39.04
1998	3	14	195.2	6.19	83.4	12.33	4	204.1	3.35	99.3	9.54
	4	15	200.2	12.09	89.2	16.62	16	214.9	9.84	119.9	20.76
	5	4	223.6	23.20	137.8	34.88	7	221.5	14.57	131.8	27.26
	6	1	210.0		115.0		1	225.0		146.0	
	7	1	243.0		178.0		1	240.0		191.0	
	8	2	235.0	10.61	158.5	20.51					
	9	1	238.0		151.0						
	Total	38	205.1	17.80	101.1	32.14	29	216.8	13.15	123.0	26.16
1999	3	1	180.0		73.0						
	4	12	201.8	5.88	104.2	9.84	8	203.9	9.98	111.4	14.13
	5	9	196.9	6.19	105.8	14.10	8	215.9	9.28	140.4	20.28
	6	2	210.0	7.07	136.5	14.85	1	235.0		166.0	
	Total	24	199.7	7.96	106.2	15.97	17	211.4	12.42	128.2	23.92
2000	4	2	208.5	12.02	115.0	12.73	3	228.0	6.56	161.7	5.86
	5	3	229.0	6.93	148.3	23.29	3	234.7	2.52	160.0	1.73
	6	3	224.3	7.02	143.7	12.42	1	240.0		172.0	
	7						1	232.0		171.0	
	Total	8	222.1	11.13	138.3	20.80	8	232.5	5.73	163.5	5.98
						Grand Lake					
1973	3	2	199.0	12.73	90.5	23.33	4	211.8	6.85	125.3	12.39
	4	22	212.1	9.58	129.4	29.06	26	226.7	9.62	152.5	20.45
	5	9	228.1	12.53	150.1	27.36	17	235.9	11.47	172.5	25.17
	6	3	246.7	14.57	208.3	31.01	4	250.5	3.70	188.5	24.45
	7	1	240.0		191.0						
	Total	37	218.8	15.90	140.4	37.67	51	230.5	13.03	159.8	26.47
1974	3	10	191.9	7.14	88.5	14.80	2	198.5	16.26	89.5	24.75
	4	8	228.6	17.00	152.3	38.69	5	232.0	4.42	164.4	10.92
	5	18	238.0	12.26	170.2	36.17	16	239.6	14.79	182.3	35.10
	6	5	256.4	23.96	220.2	48.95	8	245.0	13.41	195.3	39.58
	7	1	257.0		222.0		3	267.3	20.03	251.0	72.63
	Total	42	227.9	25.68	154.5	53.74	34	239.8	18.98	183.3	47.79
1981	3	4	220.8	8.02	135.8	18.93	1	224.0		153.0	
	4	10	235.5	8.66	164.1	21.43	18	243.6	10.72	189.4	21.25
	5	8	244.5	11.39	185.6	29.08	7	257.4	8.83	216.1	23.79
	6	4	254.5	7.51	226.3	23.51	5	259.2	3.70	223.2	16.90
	7						6	275.8	11.37	281.5	61.55
	8	2	251.5	14.85	220.0	25.46	1	280.0		312.0	
	Total	28	239.8	13.77	179.1	36.40	38	253.7	16.20	215.6	47.37
1983	3	5	198.0	10.27	95.4	16.32	1	221.0		125.0	
	4	31	223.7	9.58	135.3	18.83	28	229.4	11.04	149.0	22.84
	5	16	232.9	12.96	158.2	22.41	24	243.6	10.55	182.6	32.13
	6	8	248.8	7.50	195.3	16.66	5	262.4	10.16	203.0	18.84
	7	8	256.9	9.11	206.9	28.41	2	268.5	2.12	244.5	47.38
	8	4	260.5	7.85	213.0	26.97	5	271.4	2.79	256.8	35.03
	9	4	264.8	10.24	249.0	34.37	4	282.8	14.31	301.5	38.61
	10	1	280.0		281.0		1	282.0		328.0	
	Total	77	234.8	20.36	163.0	45.41	70	244.4	19.96	185.7	53.84

1985	3	43	192.7	6.32	86.8	9.36	19	196.2	7.09	90.9	9.83
	4	13	221.6	10.22	140.8	19.86	12	227.1	11.53	152.8	24.88
	5	4	239.0	7.87	187.5	32.10	8	251.0	9.07	222.4	20.72
	6	5	248.4	7.37	208.2	27.88	2	238.0	5.66	192.5	58.69
	7	2	256.0	5.66	237.5	3.54	3	279.7	5.03	303.0	38.94
	9	1	265.0		251.0						
	Total	68	208.0	23.07	118.9	50.28	44	222.2	27.80	150.8	68.22
1987	4	3	234.0	6.24	142.7	9.50	1	251.0		192.0	
	5	1	218.0		138.0		3	254.3	21.22	223.0	63.02
	6						1	258.0		222.0	
	7						1	262.0		242.0	
	8						1	283.0		300.0	
	9						1	264.0		282.0	
	Total	4	230.0	9.49	141.5	8.10	8	260.1	15.26	238.4	48.97
						Oromocto River					
1973	3	1	197.0		78.0						
	4	3	218.3	4.73	127.3	10.41	5	228.6	10.16	132.4	10.92
	5	14	221.0	7.62	126.6	16.85	8	240.5	4.57	172.8	20.65
	6	3	235.0	6.24	170.3	38.55	1	246.0		171.0	
	8						1	278.0		276.0	
	9	1	260.0		232.0						
	Total	22	223.2	12.86	135.2	34.12	15	239.4	13.85	166.1	39.28
1974	3	1	197.0		93.0						
	4	5	237.0	12.57	171.6	31.99	2	227.0	21.21	139.5	45.96
	5	6	241.2	12.25	175.2	43.27	1	246.0		190.0	
	6	2	250.0	8.49	202.0	43.84	3	253.7	6.03	197.0	5.57
	7						1	254.0		189.0	
	8	1	235.0		162.0						
	Total	15	237.6	15.80	171.2	41.03	7	245.0	15.70	178.4	32.88
1975	3	1	187.0		85.0						
	4	1	207.0		94.0		2	223.5	24.75	115.0	25.46
	5	3	220.0	6.56	122.3	27.79	2	223.0	2.83	134.0	1.41
	8	1	229.0		140.0						
	Total	6	213.8	15.47	114.3	27.09	4	223.3	14.38	124.5	18.36
1981	3	4	222.5	11.68	137.5	17.41	1	225.0		137.0	
	4	11	232.5	7.85	160.5	20.47	15	243.5	12.11	178.5	31.07
	5	4	248.5	15.07	195.3	43.87	13	243.0	12.48	192.2	26.52
	6						1	250.0		178.0	
	7	4	263.8	5.85	221.3	17.63					
	8	2	267.5	3.54	265.0	1.41	3	280.7	5.03	305.3	27.79
	9						1	283.0		288.0	
	Total	25	241.2	17.90	180.5	43.48	34	247.4	17.01	196.9	48.11
1983	3	1	205.0		92.0						
	4	9	224.8	7.84	146.1	19.41	10	230.3	5.68	167.7	18.75
	5	21	225.5	8.15	145.7	21.92	30	236.2	8.22	167.0	21.92
	6	6	251.2	11.87	202.3	24.54	4	240.3	6.40	184.0	15.73
	7						2	263.0	9.90	277.5	14.85
	9	1	264.0		232.0						
	Total	38	229.8	14.40	155.6	33.49	46	236.4	9.79	173.4	30.45
1985	3	6	195.2	16.88	88.3	26.59					
	4	9	225.3	4.21	145.2	10.85	4	236.5	7.05	166.0	13.44
	5	3	232.7	3.06	167.7	5.51	1	245.0		199.0	
	6	2	248.5	9.19	191.5	10.61	1	254.0		236.0	
	8						1	297.0		390.0	

	Total	20	219.7	20.17	136.2	38.54	7	248.9	22.80	212.7	83.10
1987	3	3	198.7	1.15	92.7	6.03					
	4	13	218.5	13.91	136.5	34.94	6	226.3	5.50	147.0	12.47
	5	7	226.4	12.31	152.9	23.27	10	234.2	9.10	173.2	24.73
	6	1	248.0		229.0		1	240.0		171.0	
	Total	24	219.6	15.74	139.6	38.41	17	231.8	8.66	163.8	23.60
1997	3	7	198.6	9.31	82.3	11.04	1	197.0		78.0	
	4	1	218.0		84.0						
	Total	8	201.0	11.02	82.5	10.24	1	197.0		78.0	
1998	3						3	203.0	9.17	107.7	15.14
	4	5	199.0	11.16	107.6	14.66	7	211.9	10.11	129.4	26.68
	5	1	217.0		131.0		1	238.0		200.0	
	Total	6	202.0	12.39	111.5	16.22	11	211.8	13.04	129.9	33.36
1999	4	1	220.0		131.0		1	207.0		116.0	
	5	1	220.0		126.0		3	221.3	6.03	131.3	15.04
	Total	2	220.0	0.00	128.5	3.54	4	217.8	8.69	127.5	14.48
2000	4	1	227.0		137.0						
	5						3	230.0	13.23	165.0	27.06
	6	3	232.3	2.52	155.0	7.00	1	235.0		164.0	
	Total	4	231.0	3.37	150.5	10.66	4	231.3	11.09	164.8	22.10
						French and Indian Lakes					
1973	4	5	212.4	7.64	120.0	10.00	9	228.6	10.24	149.9	18.82
	5	10	229.3	4.57	151.9	19.54	4	237.5	2.65	166.8	18.84
	6	2	232.5	6.36	153.0	21.21	2	253.5	16.26	217.0	32.53
	7						1	257.0		247.0	
	8						1	266.0		250.0	
	Total	17	224.7	9.85	142.6	22.25	17	237.5	14.89	173.4	39.68
1974	3	14	194.9	14.81	89.5	31.76	3	203.3	12.58	104.3	15.31
	4	20	223.9	17.85	137.7	40.07	4	232.3	24.02	145.8	41.86
	5	20	241.7	14.12	171.1	32.25	13	249.6	14.26	187.1	35.57
	6	6	246.2	18.73	187.3	38.43	10	249.1	16.82	198.1	47.26
	7						1	257.0		173.0	
	9						1	260.0		195.0	
	Total	60	225.3	24.49	142.6	48.53	32	243.5	20.97	177.4	46.44
1975	4	4	217.0	18.57	131.0	20.22	6	226.0	7.51	163.3	21.82
	5	3	231.7	9.71	155.3	22.74	8	232.9	9.82	172.8	33.88
	6	2	241.0	4.24	191.5	3.54	2	250.0	18.38	194.5	24.75
	Total	9	227.2	16.19	152.6	29.98	16	232.4	12.01	171.9	28.86
1981	3	2	223.5	9.19	136.5	9.19					
	4	12	232.3	7.37	167.4	17.04	5	237.6	8.41	181.8	17.08
	5	3	238.3	5.77	181.7	22.90					
	6	2	255.5	7.78	224.5	36.06	1	264.0		245.0	
	7						1	273.0		300.0	
	Total	19	234.7	10.64	172.4	28.08	7	246.4	16.77	207.7	49.04
1983	3	1	202.0		101.0						
	4	26	222.3	6.60	135.5	18.18	23	229.2	7.27	158.9	21.53
	5	17	226.0	7.89	148.1	20.53	9	235.2	7.33	171.9	20.59
	6	3	238.0	13.11	184.3	22.55	2	255.5	4.95	182.5	0.71
	7	1	247.0		208.0		2	254.5	16.26	210.5	34.65
	8	1	265.0		203.0						
	9	1	257.0		252.0						
	Total	50	226.1	11.71	147.1	29.86	36	233.6	10.93	166.3	24.35

1985	3	11	198.1	9.31	95.6	11.75	1	217.0		136.0	
	4	5	215.6	11.87	128.4	25.19	6	229.5	5.65	148.2	16.34
	5	1	223.0		165.0		2	247.5	17.68	140.0	48.08
	6	2	246.0	15.56	178.5	14.85	2	252.5	3.54	194.0	8.49
	Total	19	209.1	18.46	116.6	33.06	11	235.8	13.81	153.9	28.00
1997	3	1	202.0		86.0						
	4						1	235.0		146.0	
	6	1	253.0		178.0						
	Total	2	227.5	36.06	132.0	65.05	1	235.0		146.0	
1998	3	6	197.6	9.40	93.2	17.06					
	4	18	208.0	13.97	111.1	23.05	13	216.2	11.37	125.7	24.41
	6						1	265.0		215.0	
	Total	24	205.4	13.58	106.4	22.75	14	219.7	17.05	132.1	33.46
1999	4	5	203.4	2.30	106.4	5.18	5	206.8	8.90	123.0	16.82
	5	9	201.2	6.46	111.0	11.59	12	206.8	5.75	125.4	11.16
	Total	14	202.0	5.33	109.4	9.80	17	206.8	6.52	124.7	12.56
2000	3	1	210.0		103.0		2	228.0	2.83	163.0	36.77
	4	6	220.8	9.56	137.7	16.37	4	219.0	5.89	131.0	14.09
	5	3	234.3	20.84	149.3	32.32	2	223.5	9.19	158.5	28.99
	6	1	222.0		123.0		11	233.0	6.31	169.2	15.23
	Total	11	223.6	13.80	136.4	22.88	19	228.5	8.26	159.4	22.87
						Belleisle Bay					
1974	3	8	189.6	5.04	84.8	9.90	.	.	.	.	.
	4	4	219.3	3.77	130.5	18.34	10	232.0	5.85	160.2	23.28
	5	10	227.5	14.38	150.1	29.95	13	236.0	11.20	173.8	21.56
	6	8	233.4	9.77	167.8	27.43	8	247.1	8.36	188.4	16.99
	7	1	241.0		193.0		6	251.2	4.26	210.0	24.86
	8	1	257.0		201.0		1	265.0		275.0	
	Total	32	219.8	21.20	138.7	41.53	38	240.4	11.64	181.7	30.69
						Kennebecasis Bay					
1974	3	1	197.0		74.0						
	4	9	210.2	3.63	116.0	8.77	5	222.8	16.28	153.8	34.59
	5	16	225.2	9.95	144.2	25.36	15	232.7	9.51	170.1	30.82
	6	17	235.5	9.37	176.2	30.01	12	245.3	13.71	204.3	39.08
	7	6	238.0	8.44	190.7	29.82	4	258.0	4.90	217.3	30.92
	8	2	257.0	11.31	207.5	3.54	4	268.5	5.32	254.8	35.44
	Total	51	228.2	14.60	156.5	37.93	40	241.4	17.26	191.5	44.17
1975	3	5	189.2	3.70	78.4	7.30	1	188.0		76.0	
	4	10	213.9	8.60	116.3	20.04	7	218.3	4.89	124.0	12.57
	5	13	224.2	9.30	144.8	22.05	20	230.2	14.68	152.6	26.65
	6	44	229.0	9.24	151.9	23.30	30	241.1	6.45	186.4	26.67
	7	32	237.8	11.11	174.2	33.41	13	247.8	8.01	201.2	29.19
	8	11	241.9	7.63	201.1	36.20	9	267.1	12.93	249.2	37.56
	9	6	261.5	15.55	252.7	55.20	5	265.8	11.05	258.4	51.18
	10						3	278.0	7.21	302.0	55.05
	Total	121	230.7	16.28	160.5	43.85	88	242.5	18.76	189.1	52.43

1981	3	2	201.0	5.66	100.5	14.85					
	4	5	224.0	7.04	134.6	20.55	3	230.7	8.08	149.3	36.09
	5	5	247.4	9.58	182.6	39.63	6	249.8	11.65	208.0	50.02
	6	8	250.4	7.15	195.4	29.36	9	261.3	4.18	243.8	47.33
	7	17	256.9	8.87	218.4	33.61	16	268.7	9.86	240.4	53.54
	8	32	259.7	6.44	230.3	29.05	42	268.7	7.55	251.4	44.96
	9	9	263.8	8.80	235.0	30.10	14	273.9	11.73	276.8	54.32
	10	5	271.6	6.02	276.4	40.83	20	282.3	9.20	297.2	65.51
	11	1	271.0		296.0		8	288.1	6.66	326.9	41.27
	12	1	280.0		339.0		1	320.0		363.0	
	Total	85	255.6	15.06	218.4	47.61	119	270.8	14.43	261.3	60.58